ACM SenSys 2007 Demo:
Acoustic Sensor Networks for Environmental Monitoring

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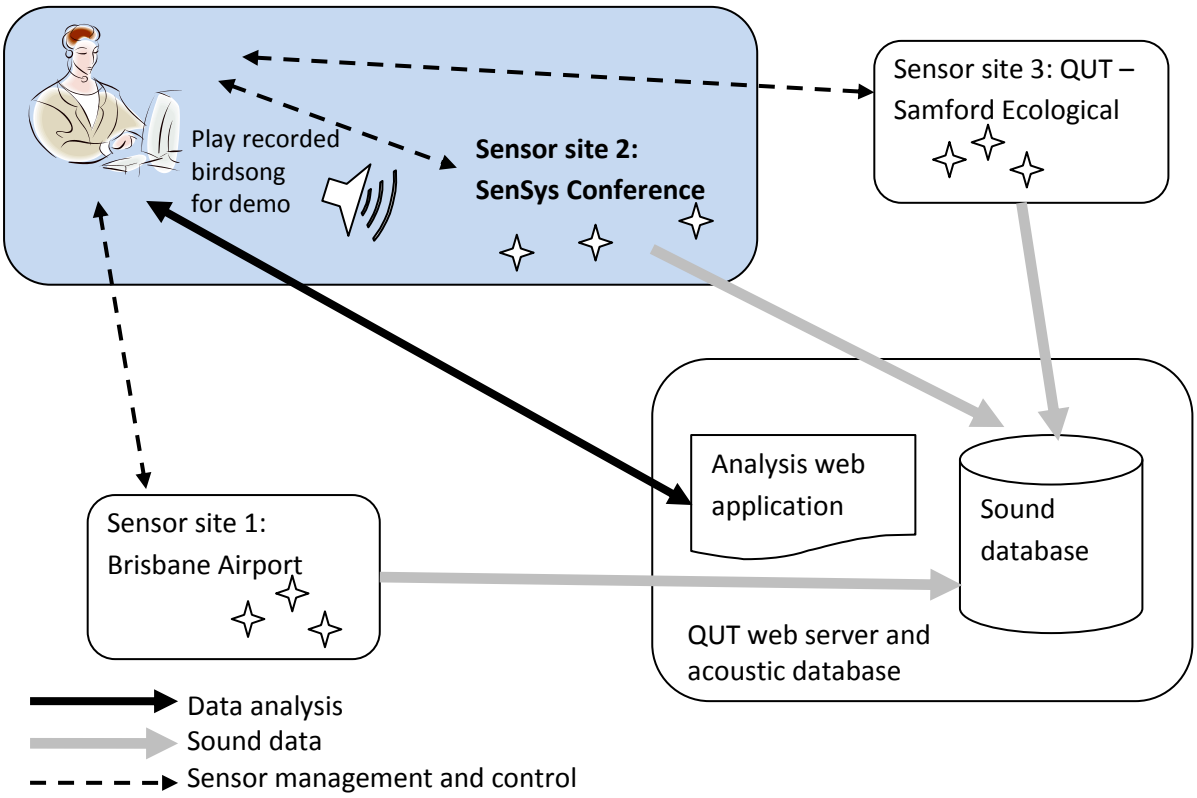
In this demonstration, we will show how smartphones can be used as a platform for monitoring environmental change, particularly with respect to birdlife. We have researched and implemented a platform using Microsoft smartphones for remotely monitoring birds. The platform comprises smartphones running a custom application for recording bird song. The application manages sensors in an autonomic fashion to ensure that they operate reliably for long periods of time in a power efficient manner. Recorded birdsong is uploaded to a relational database through the Telstra NextG network. This network is being rolled out throughout regional Australia and provides a powerful networking infrastructure for remote sensing. The nature of acoustic sensing means that large volumes of data are collected so data communication and optimisation is important. The sensors and hence recording can be remotely controlled through a web service interface.

Sound data is collected and stored in a relational database. This database is then analysed to recognise different birds and bird calls using a neural network. A novel noise reduction technique is employed prior to identification. This technique is notable for not requiring noise-only reference frames for initial noise estimation. Before the recognition process is undertaken, sophisticated noise reduction techniques are employed. The analysis potentially enables the location, type of bird and bird behaviour (through bird call), to be known. From this, profiles of bird population and behaviour over time can be studied and the effects of environmental change can be known. The sensors are laid out in a grid so that in addition to collecting sound, the location of birds can be detected. Such information will help to determine when in the day the birds are active and which sections of the wetlands are used.

The sensors are being deployed in some wetlands which are part of Brisbane airport. These wetlands are the habitat for much wildlife including the rare Lewins Rail. This bird is the focus for our study. A second runway is being constructed at Brisbane airport and the sensors are being used to measure the impact of the runways construction and operation on the environment and particularly to Lewins Rail about which not much is known.

In this demo, we will demonstrate the web-based interface for analysing sensor data and for controlling sensors. We will demonstrate through the web-based interface access to remote sensors at Brisbane airport in addition to access to several local sensors deployed at the conference. By playing back some pre-recorded birdsong at the conference site, the collection and analysis of sensor data will be demonstrated, including the recognition by the web-based system of the birdsong played. We will also demonstrate the noise reduction techniques we have developed and sound location identification.



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